

ABSTRACT

Methods and apparatus are provided for detecting a target substance in an atmospheric target area. The target area is illuminated with a laser beam to produce back-scatter light from substances within the target area. The back-scatter light is combined with a sample of the target substance within a hollow core fiber that has been pumped with a laser spectrum identical to the illuminating beam. If a back-scatter spectrum matches the pumped sample in the hollow core fiber, stimulated Raman scattering emissions can occur, which provide optical gain for the matching spectrum. A detector analyzes the amplified matching spectrum to identify the target substance. The disclosed apparatus may be expanded to detect multiple target substances simultaneously by using hollow core fibers containing different target samples.